

AMENDMENTS TO THE SPECIFICATION:

Please replace the paragraph beginning at page 2, line 6, with the following rewritten paragraph:

--The anode of JP-A-2002-260637 has the active material particles exposed to an electrolytic solution. Therefore, the active material particles are apt to fall off the anode through repetition of expansion and contraction accompanying intercalation and deintercalation of lithium ions. As a result, a battery using the anode tends to have a reduced cycle life. In addition, because the current collector used in the anode has a relatively large thickness (10 to 100  $\mu\text{m}$ ), the proportion of the active material in the anode is relatively small, which makes it difficult to increase the energy density. In the anode of JP-A-2002-289178, the thin copper film covering the thin tin film (active material layer) is as thin as 0.01 to 0.2  $\mu\text{m}$  and is distributed as islands. Therefore, the active material layer is exposed, for the most part, to an electrolytic solution. Hence, for the same reason as with the anode of JP-A-2002-260637, the active material is liable to fall off accompanying intercalation and deintercalation of lithium ions.--

Please replace the paragraph beginning at page 6, line 32, with the following rewritten paragraph:

--The anode 10 of the first embodiment has a pair of surfaces that are to come into contact with an electrolytic solution; a first surface 1 and a second surface 2 (not shown).

The anode 10 has an active material layer 3 containing active material particles 2 having high capability of forming a lithium compound between the two surfaces. The active material layer 3 is continuously coated on both sides thereof with a pair of current collecting surface layers 4 (only one of them is shown). The surface layers 4 contain the first surface 1 and the second surface 2, respectively. As is apparent from Fig. 1, the anode 10 has no thick conductor film (e.g., a metal foil) for current collection called a current collector that has been used in conventional anodes, such as those described in JP-A-2002-260637 and JP-A-2002-289178 *supra*.--

Please replace the paragraph beginning at page 7, line 10, with the following rewritten paragraph:

--The current collecting surface layers 4 serve for current collecting function of the anode 10 of the subject embodiment. The surface layers 4 also serve to prevent the active material particles of the active material layer 3 from falling off due to their volumetric change during lithium ion intercalation/deintercalation cycling. The surface layers 4 are made of a metal capable of functioning as a current collector of a nonaqueous secondary battery, preferably of a lithium secondary battery. Such a metal includes metallic materials having low capability of forming a lithium compound, such as copper, nickel, iron, cobalt, and alloys of these metals. Of these metallic materials particularly preferred are copper, nickel, or an alloy

thereof. Nickel is preferred for enhancing the strength of the electrode 10. Copper is preferred for increasing flexibility of the anode 10. The two surface layers can be made of the same or different materials. The expression "low capability of forming a lithium compound" as used herein means no capability of forming an intermetallic compound or a solid solution with lithium or, if any, the capability is such that the resulting lithium compound contains only a trace amount of lithium or is very labile.--

Please replace the paragraph beginning at page 18, line 4, with the following rewritten paragraph:

--Where the active material particles 2 are silicon-containing particles, it is preferred for the particles to have an average particle size ( $D_{50}$ ) of 0.1 to 10  $\mu\text{m}$ , particularly 0.3 to 8  $\mu\text{m}$ , especially 0.8 to 5  $\mu\text{m}$ , whichever of the forms (a) to (e) the silicon-containing particles may be. That is, the active material particles are fine particles with a small diameter (hereinafter referred to as "small-diametered active material particles"). Use of such small-diametered active material particles in an anode results in reduced fall-off of the active material particles and makes it feasible to extend the life of the anode. In more detail, active material particles are to greatly change in volume on intercalating and deintercalating lithium and are to be disintegrated into microcrystallites or fine particles in due course of time. It follows that cracks develop, and part of the active material particles lose electrochemical contact

among themselves, which causes reduction in charge/discharge cycle characteristics important for a secondary battery. For this reason, fine particles of small size are used to prepare the anode thereby to suppress further size reduction of the particles and to improve the charge/discharge cycle characteristics. Incidentally, if the small-diametered active material particles have an average particle size smaller than the lower limit of the above-specified range, the particles are susceptible to oxidation. Moreover, such small particles are costly to produce. The particle size of the small-diametered active material particles is measured by a laser diffraction scattering method or under electron microscopic (SEM) observation.--

Please replace the paragraph beginning at page 21, line 30, with the following rewritten paragraph:

--The metal making up the thin metal coat is preferably selected from those having low capability of forming lithium compound. Such metals include Ni, Cu, Co, Fe, Ag, and Au. Ni, Co, Ag, and Au are preferred from the standpoint of oxidation prevention. These metals can be used either individually or in the form of an alloy composed of two or more thereof.--

Please replace the paragraph beginning at page 27, line 13, with the following rewritten paragraph:

--In the subject process of production, it is possible to press the active material layer 3 before the electroplating. For the sake of distinguishing from the above-mentioned pressing

of the anode, the pressing before the electroplating will be called prepressing. Prepressing is effective in preventing separation between the active material layer 3 and the surface layers 4 and preventing the active material particles 2 from being exposed on the surface of the electrode 10. As a result, deterioration of battery cycle life due to fall-off of the active material particles 2 can be averted. Besides, prepressing is effective in controlling the degree of penetration of the material constituting the surface layers 4 into the active material layer 3 (see Example given later). Specifically, a high degree of pressing results in reduction of the distance between active material particles 2, which makes the active material layer 3 less permeable to the material constituting the surface layers 4. Conversely, when the degree of pressing is small, the distance between the active material particles 2 remains long and ready to allow the material making up the surface layers 4 to penetrate into the active material layer 3. The prepressing conditions are preferably such that the thickness of the active material layer 3 after prepressing is 95% or less, particularly 90% or less, of that before prepressing.--

Please replace the paragraph beginning at page 29, line 15, with the following rewritten paragraph:

--After the coating layer of the slurry dries to form the active material layer 3, the active material layer 3 is electroplated with a metallic material having low capability of

forming a lithium compound to form a current collecting surface layer 4b, the other of the pair. The electroplating can be carried out under the same conditions as in the electroplating of the first process. By properly adjusting the electrolysis conditions, the surface layer 4b is formed while allowing the material making up the surface layer 4b to penetrate throughout the thickness of the active material layer 3, thereby providing an electrical connection between the surface layers 4a and 4b. In addition, a great number of the above-described microvoids are easily provided in the surface layer 4b. After the formation of the surface layer 4b, the surface layers 4a and 4b and the active material layer 3 may be pressed all together to form microvoids 5 in the surface layers 4a and 4b. The active material layer 3 may be subjected to prepressing before the surface layer 4b is formed on the active material layer 3.--

Please replace the paragraph beginning at page 29, line 28, with the following rewritten paragraph:

--Finally, the carrier foil 11 is peeled apart from the surface layer 4a to give an anode 10.--

Please replace the paragraph beginning at page 32, line 23, with the following rewritten paragraph:

--A material for making the surface layer 4a is then deposited on the release layer 11a by electroplating to form the surface layer 4a as shown in Fig. 7(e). The resulting surface layer 4a contains a great number of microvoids. While Fig. 7(e)

shows that the microvoids are formed at positions on the top of the coat 22, the aim of this depiction is only for the sake of convenience. In fact, the microvoids are not always formed at positions on the top of the coat 22. The plating bath and plating conditions are chosen appropriately according to the material of the surface layer 4a. In making the surface layer 4a of Ni, for instance, a Watts bath having the composition shown below or a sulfamic acid bath can be used as a plating bath. In using these baths, the bath temperature is preferably about 40 to 70°C, and the current density is preferably about 0.5 to 20 A/dm<sup>2</sup>.--

Please replace the paragraph beginning at page 36, line 8, with the following rewritten paragraph:

--A process for producing the anode according to the subject embodiment is briefly described below. An electrically conductive slurry containing active material particles is applied to both sides of a metal foil layer 8 to form active material layers. The metal foil layer 8 may be previously produced or be produced in an in-line step of the production of the anode. Where the metal foil layer 8 is in-line produced, it is preferably produced by electrolytic deposition. After the applied slurry dries to form active material layers, the metal foil layer 8 having the active material layers thereon is immersed in a plating bath containing a metallic material having low capability of forming a lithium compound and electroplated in this state with the metallic material to form the surface layers 4a and 4b. By

this process a large number of microvoids can easily be formed in the surface layers 4a and 4b, and the conductive material making the surface layers 4a and 4b penetrates the whole thickness of the active material layers to provide an electrical connection between both the surface layers and the metal foil layer 8.--

Please replace the paragraph beginning at page 49, line 4, with the following rewritten paragraph:

--The carrier foil was immersed in a Watts bath having the composition shown below to carry out electroplating thereby to form a first surface layer of nickel. The current density was 5 A/dm<sup>2</sup>, and the bath temperature was 50°C. A nickel electrode was used as an anode, and a direct current power source was used as a power source. The surface layer was formed to a thickness of 3 μm. The carrier foil with the first surface layer was pulled out of the plating bath, washed with pure water for 30 seconds, and dried in the air. The scanning electron micrograph of the thus formed surface layer and a photograph taken of that layer with light transmitted therethrough are shown in Figs. 10(a) and 10(b), respectively.--

Please replace the paragraph beginning at page 50, line 2, with the following rewritten paragraph:

--The anode obtained in the Example was evaluated for the charging characteristics in accordance with the method described below. The results obtained are shown in Figs. 10(a) and 10(b). Fig. 11(a) represents the charging characteristics



measured on the surface layer side having been separated from the carrier foil (i.e., the first surface layer side). Fig. 11b) represents the charging characteristics measured on the plated side (i.e., the second surface layer side). The diameter and density of the microvoids formed in the first and second surface layers of the anode obtained in the Example were measured in accordance with the following method. The results obtained are shown in Table 3-1 below.--

Please replace the paragraph beginning at page 52, line 1, with the following rewritten paragraph:

--As is apparent from the results shown in Table 3-1 and Fig. 11, the anode of the Example provides sufficient capacity on both the carrier foil side and the plated side. This means that the electrolytic solution in the anode of the Example is sufficiently supplied to the active material layer through the first and the second surface layers.--